Evaluation of AIRS V6 Temperature Profiles and Surface-Based Inversions over Antarctica using Concordiasi Dropsonde Data

Patrick Boylan[1]

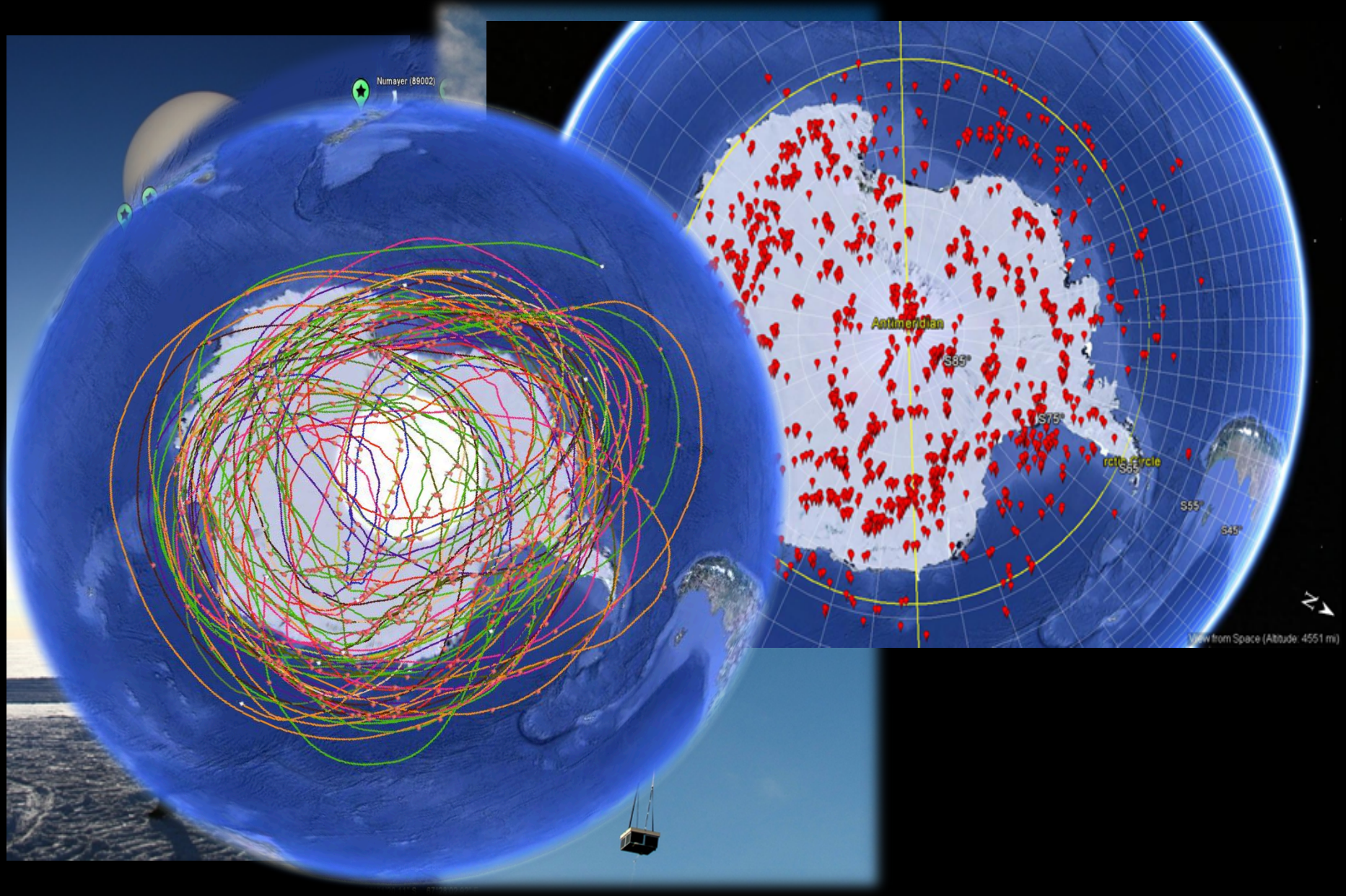
Thanks to Junhong Wang[2], Steve Cohn[1], Eric Fetzer[3], Eric Maddy[4], and Sun Wong[3]

[1]National Center for Atmospheric Research (NCAR), Earth Observing Laboratory, Boulder, Colorado, USA
[2]Department of Atmospheric and Environmental Science, University at Albany, SUNY, Albany, NY, USA
[3]Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, USA
[4]Science and Technology Corporation at NOAA/NESDIS/STAR, College Park, MD, USA

Motivation & Research Questions

- How well do available satellite products capture the temperature profile over Antarctica?
- Can these satellite products be used to detect surface-based temperature inversions (SBI)?
- If so, can we identify annual trends in SBIs over Antarctica?

Observations in Antarctica are hard to come by

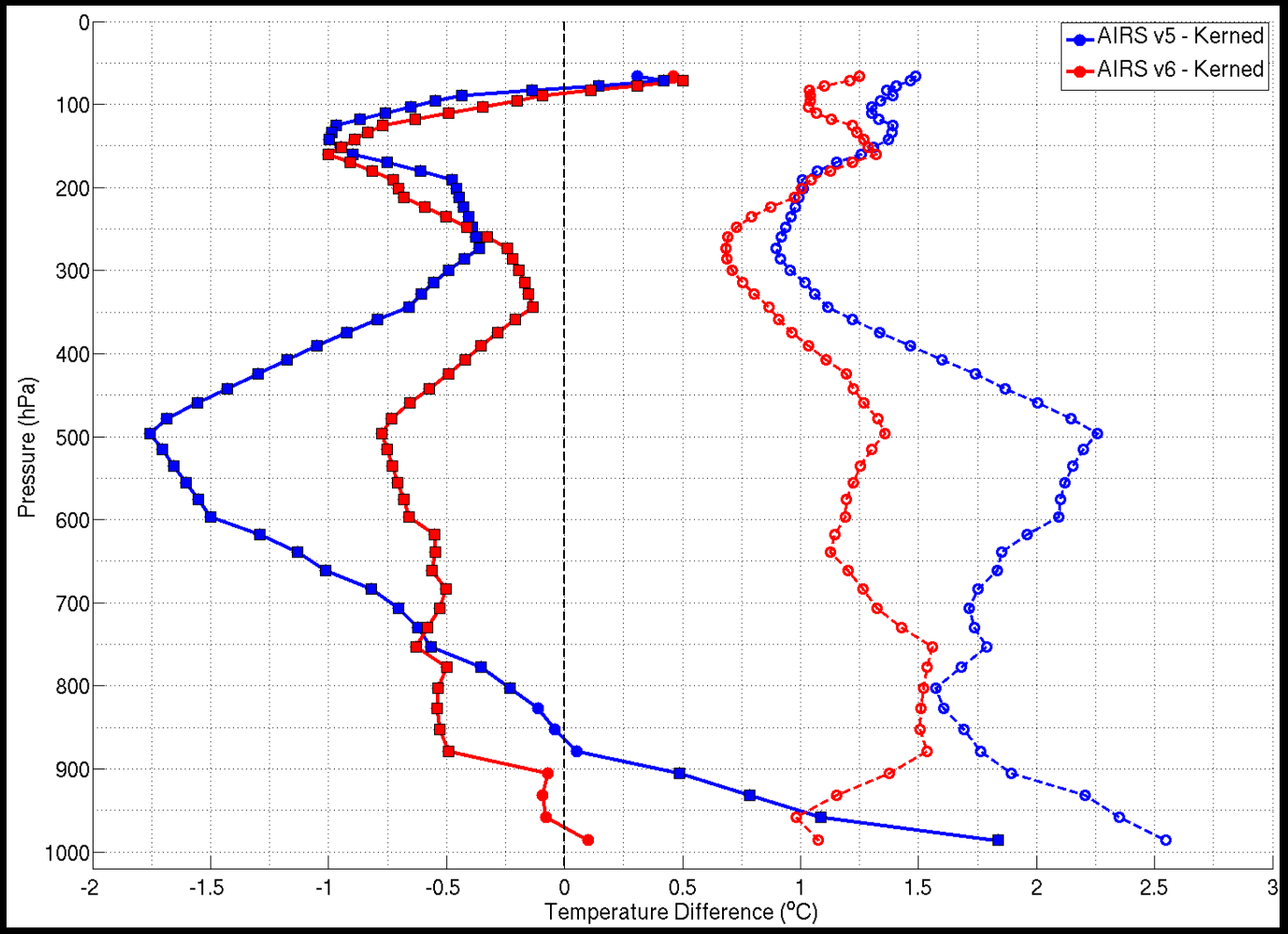



Sonde
AIRS v6
Pressure (hPa)
Altitude (m)
Temperature (°C)
700
750
800
850
900
950
1000
2590
2100
1600
1160
720
360
0
-26
-25
-24
-23
-22
-21
-20
-19
-18
-17

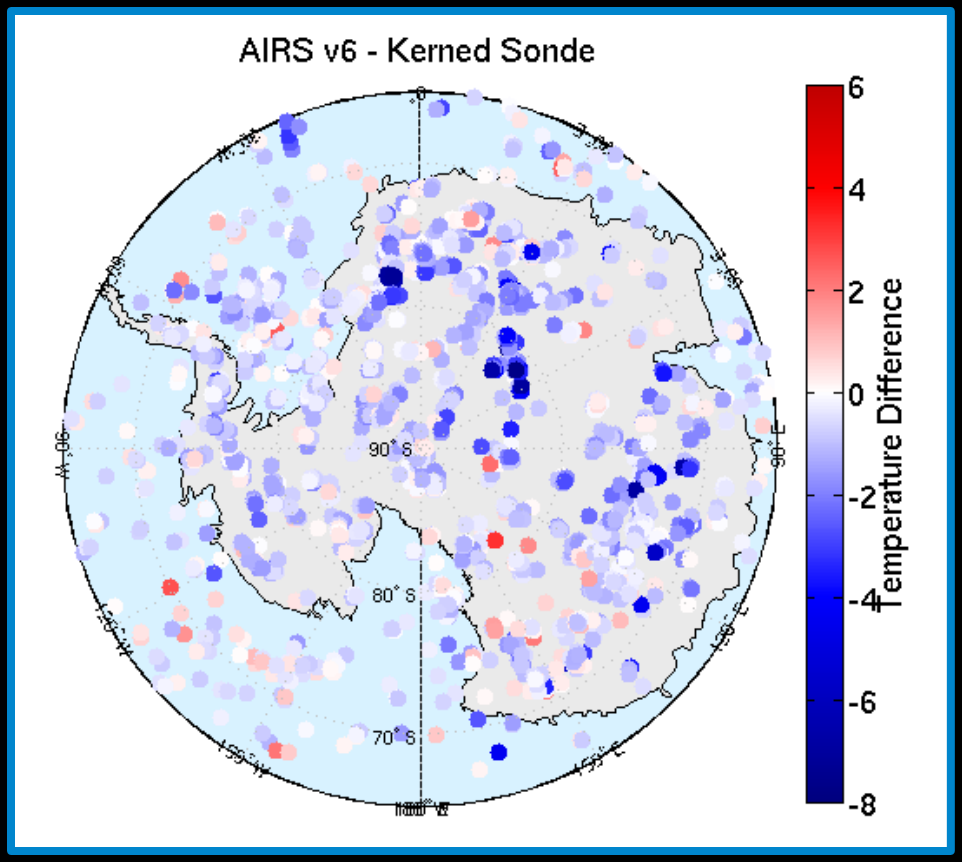
Temperature Comparison - AIRS vs Sonde

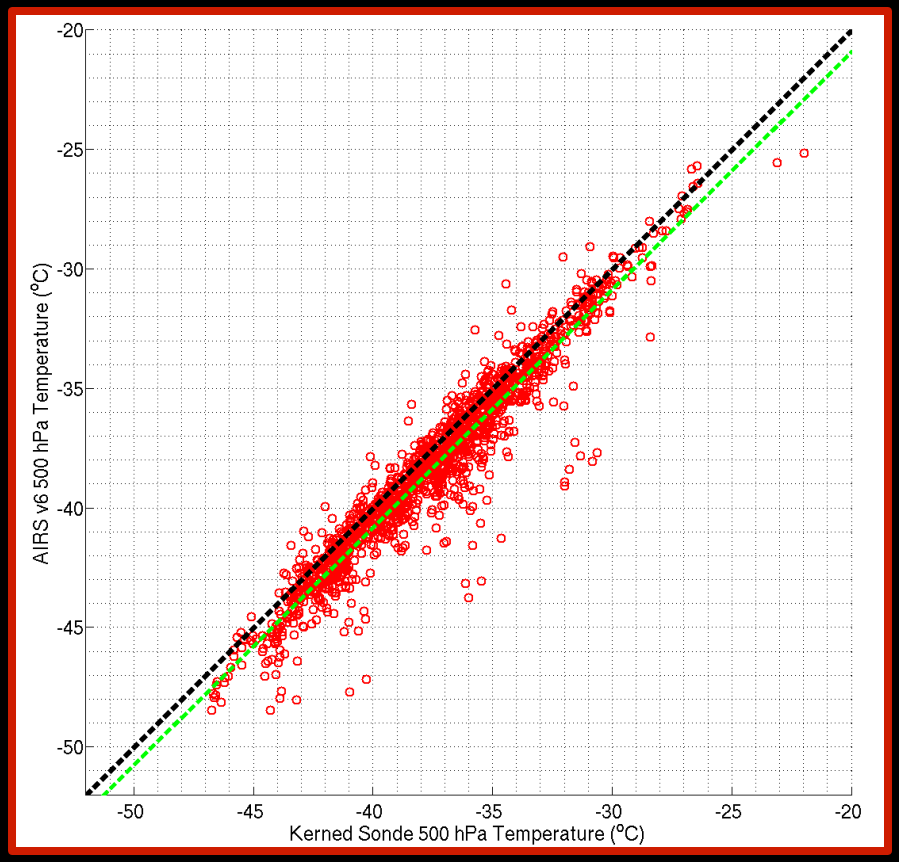
Potential Confounding Factors:

- Surface type
- Cloud cover
- Surface elevation
- Matching distance/ time
- Lat/Lon

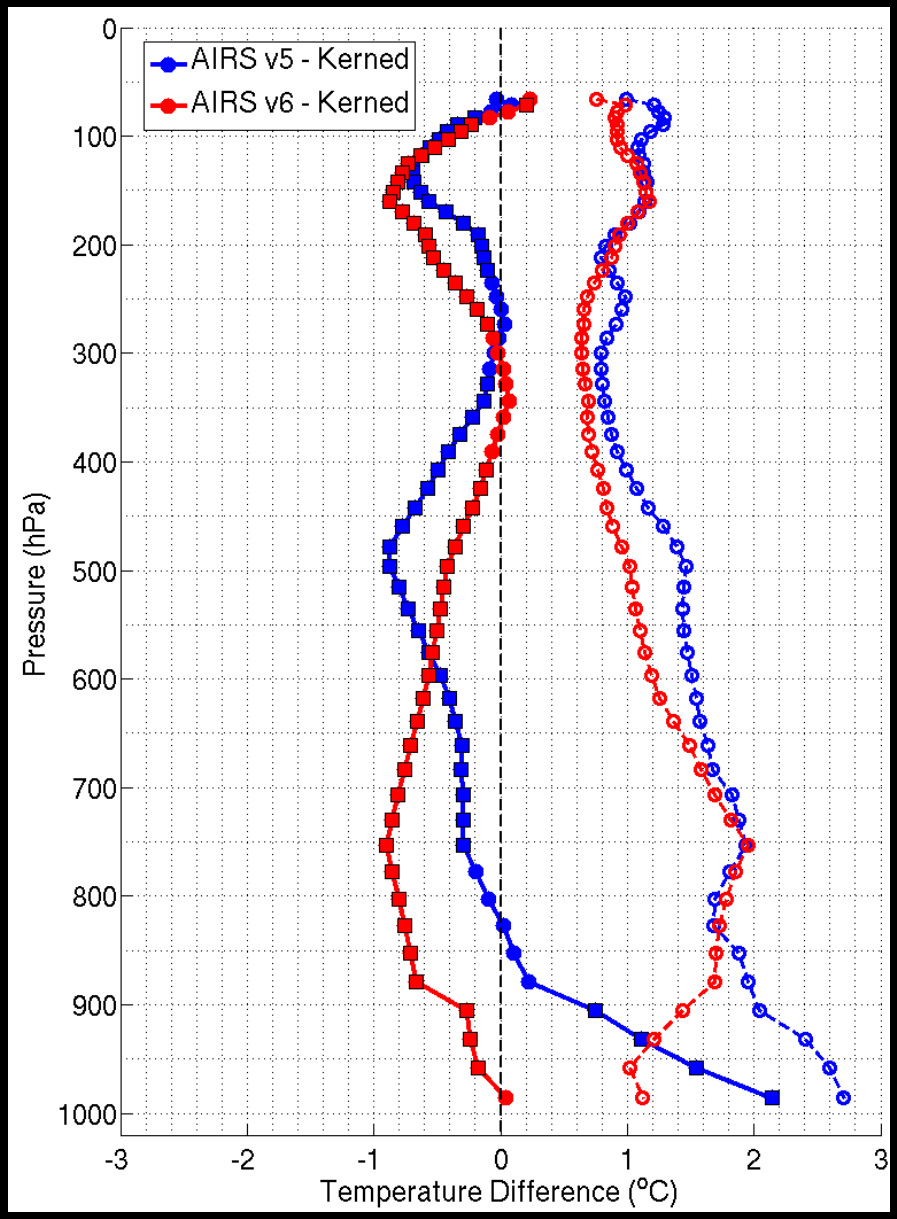


Temperature Comparison – 500 hPa

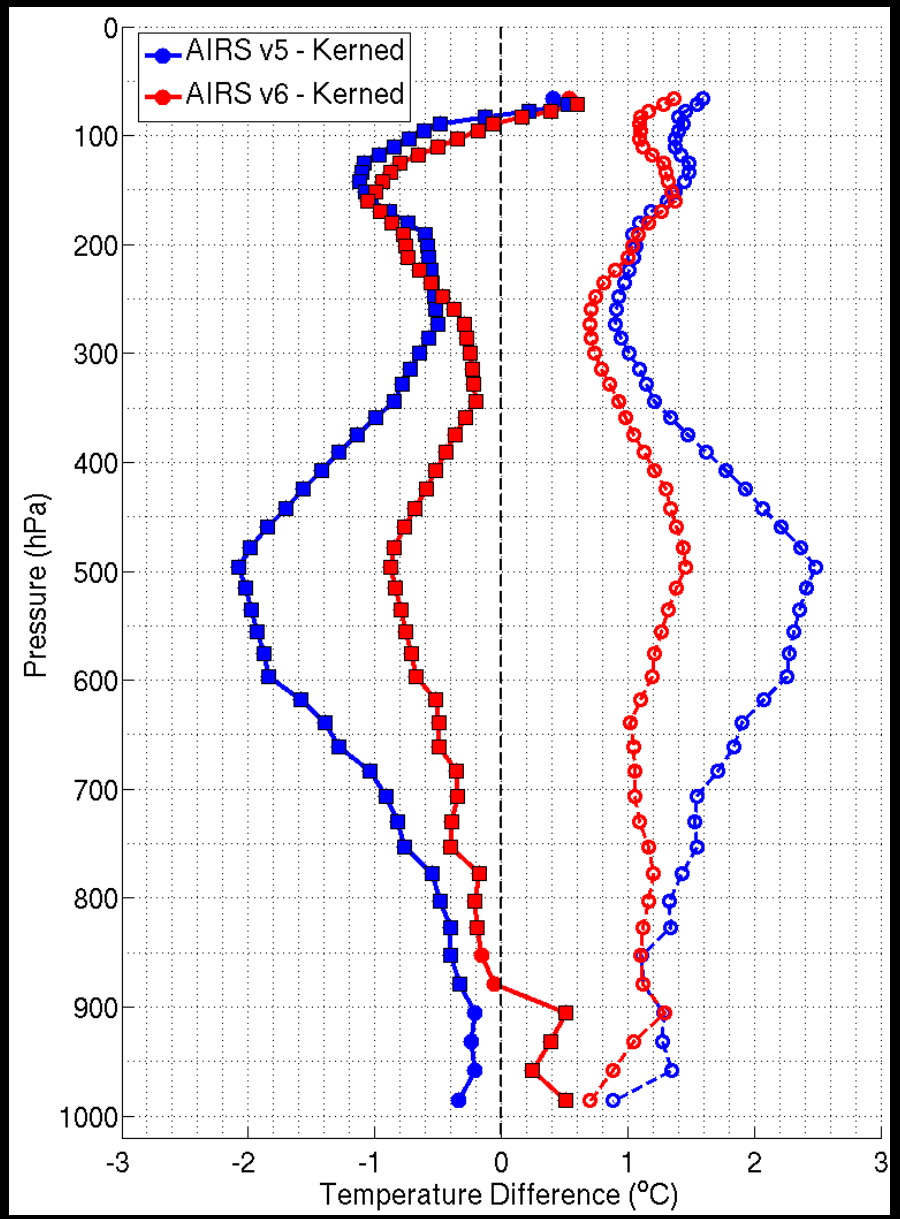




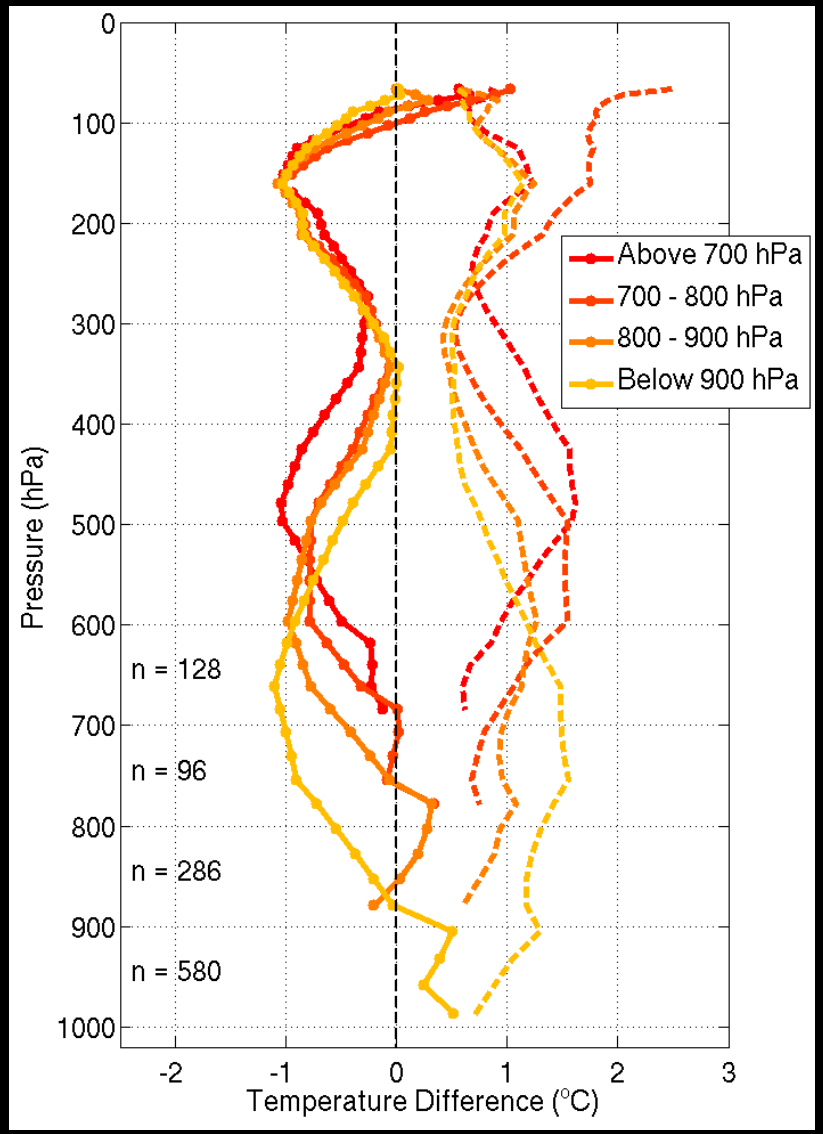
Sea Ice - 20%



Snow - 77%



Temperature Comparison by Elevation over Snow



Temperature Evaluation Highlights

- Over Antarctica, AIRS Version 6 reduces the bias and RMSE compared to version 5.
- Version 6 bias dependent on surface type and surface elevation.
- Matching distance / time is not a factor - not true globally.
- Can AIRS profiles be used to detect surface-based temperature inversions?
    - What about the surface air temperature?

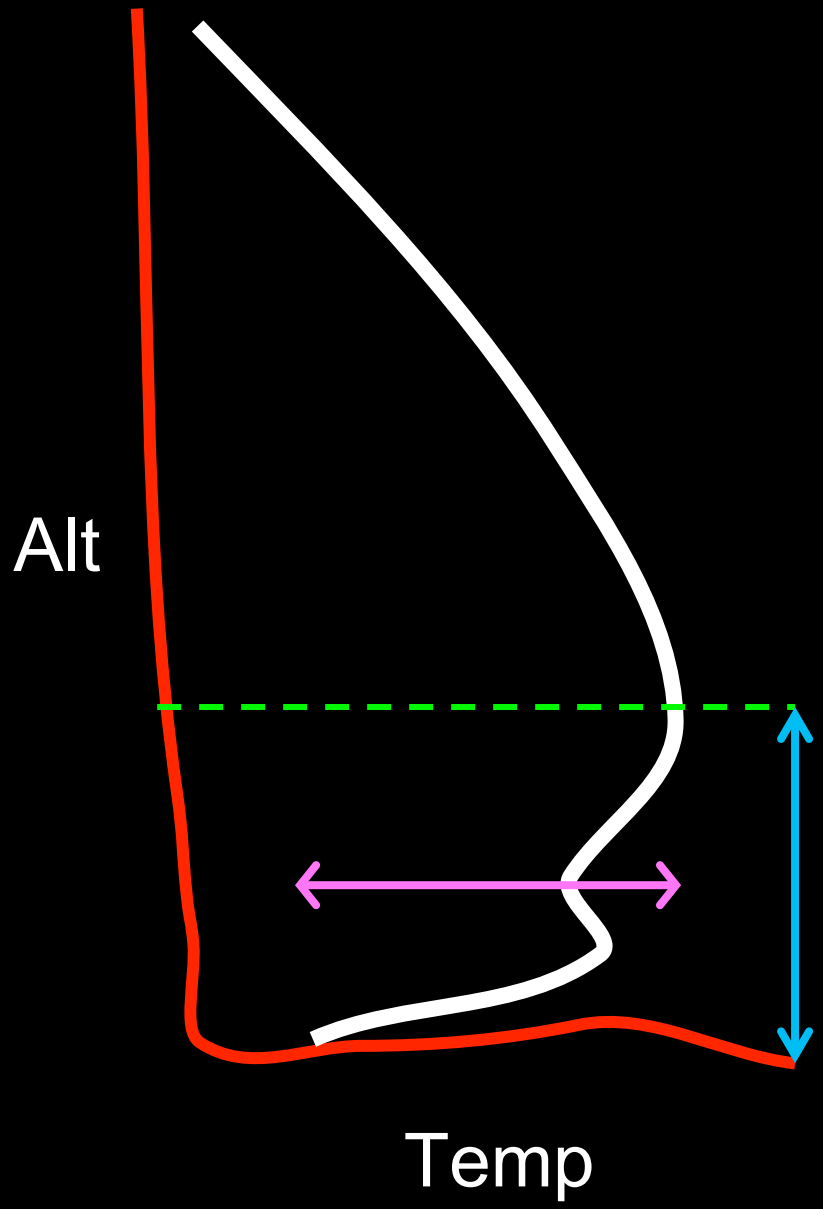
Surface-Based Inversions

3 Characteristics:

Frequency - Occurrence

Depth (m)

Intensity (°C)



Surface-Based Inversions

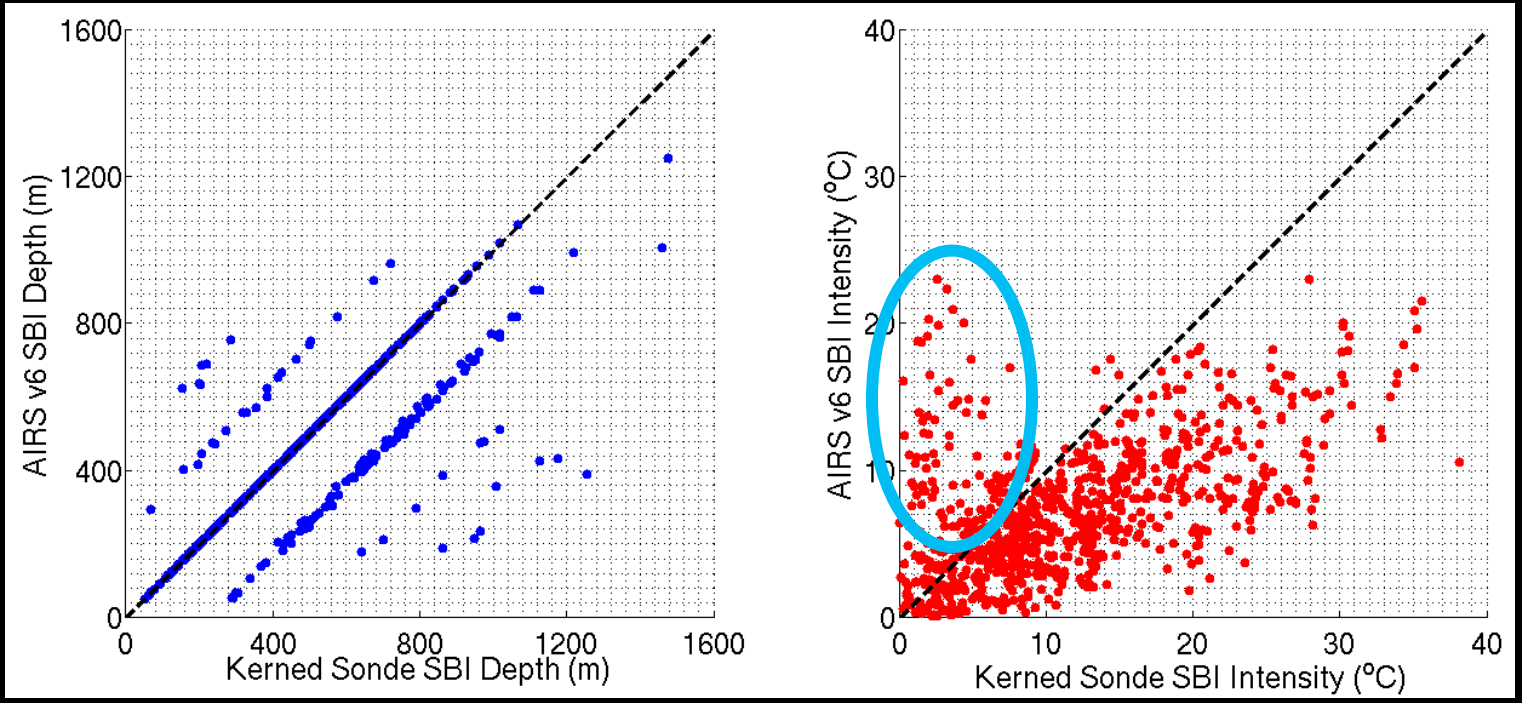
Agreement: 79%

		Kerned Sonde		
		Yes	No	Total
AIRS	Yes	**57%**	10%	999
	No	11%	**22%**	487
	Total	1007	479	1486

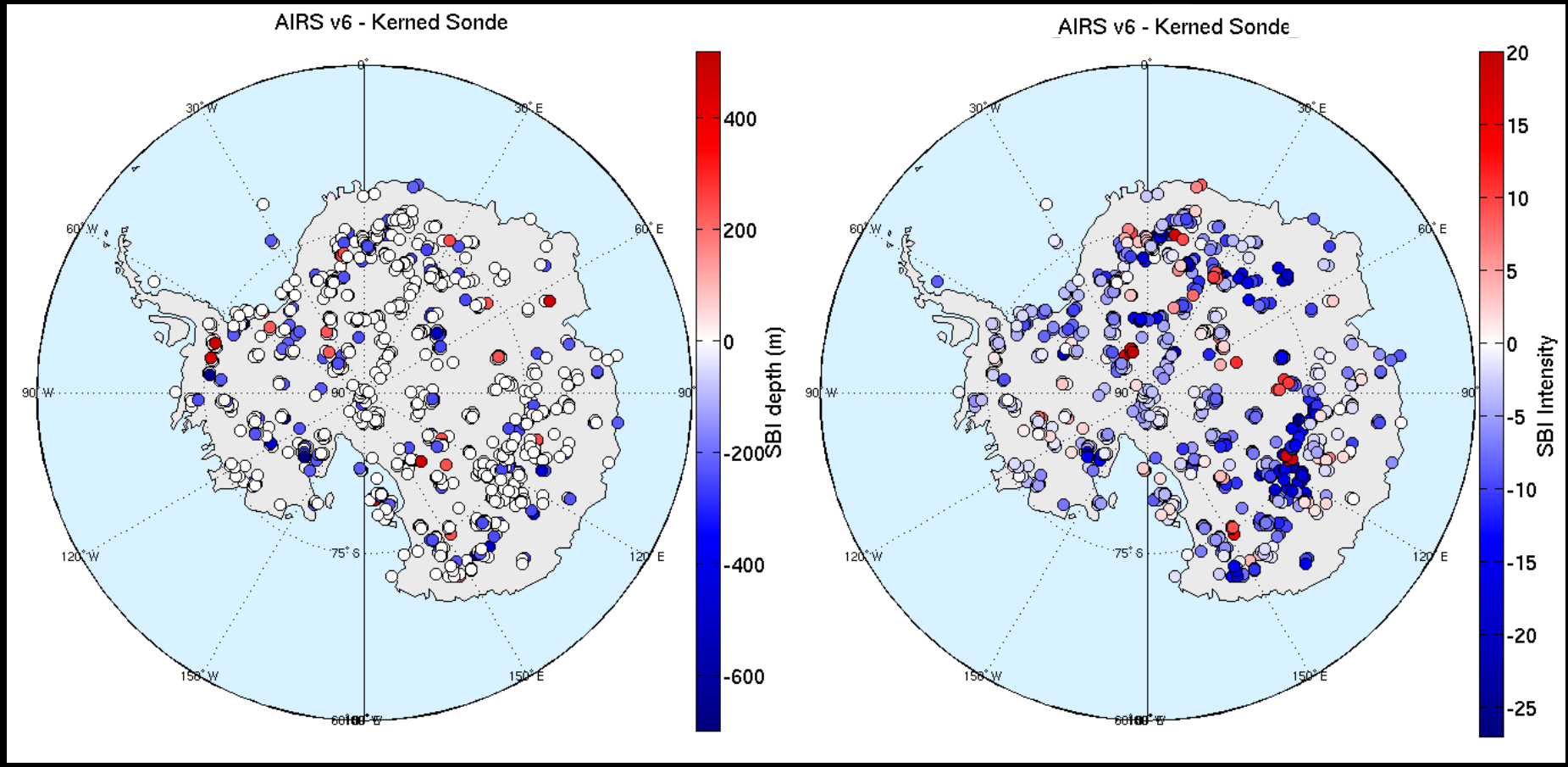
Discrete layers for SBI depth:

Agree: 79%
+/- 1 level: 97%

Sonde intensities larger …



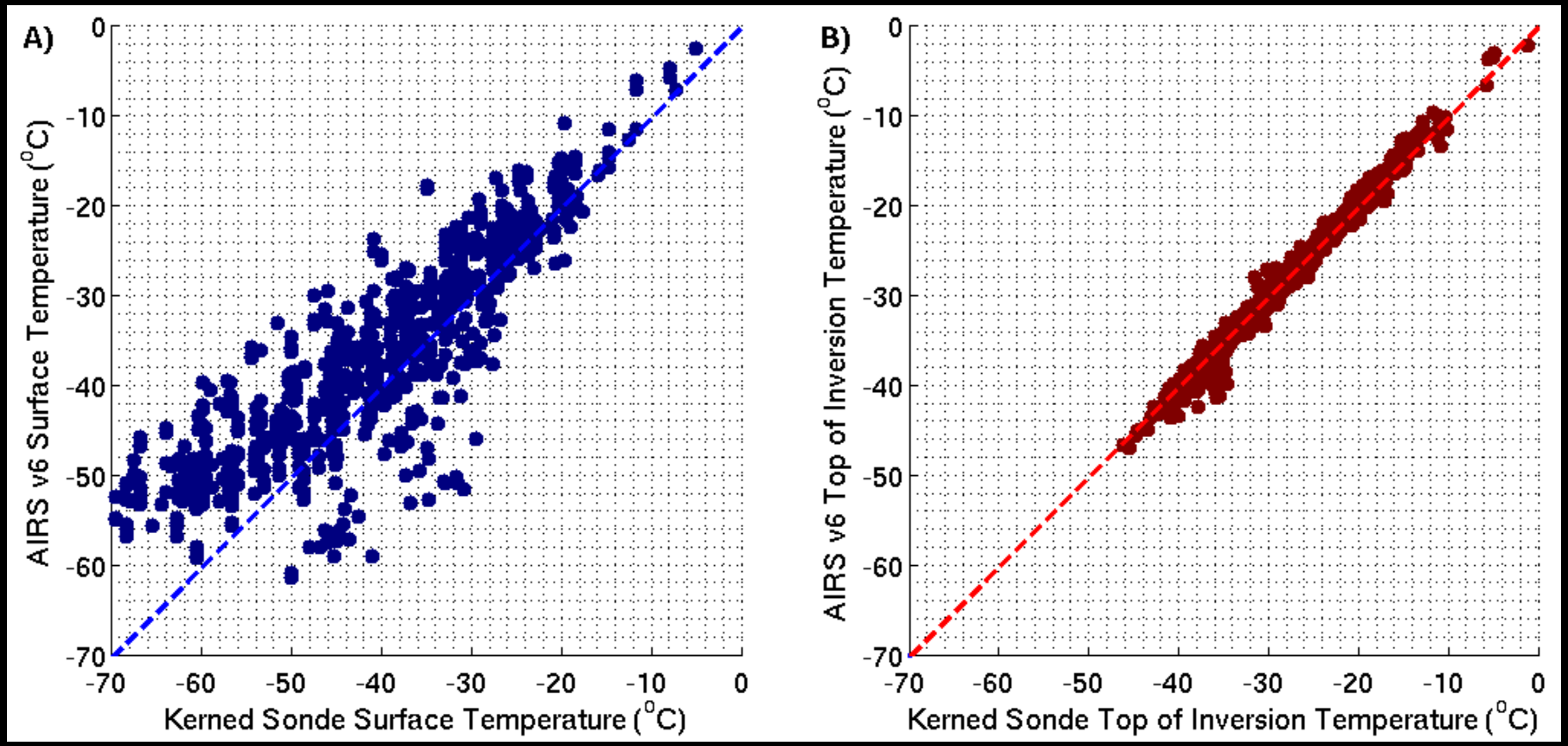
Differences between depth and intensity



Inversion Temperatures

Surface

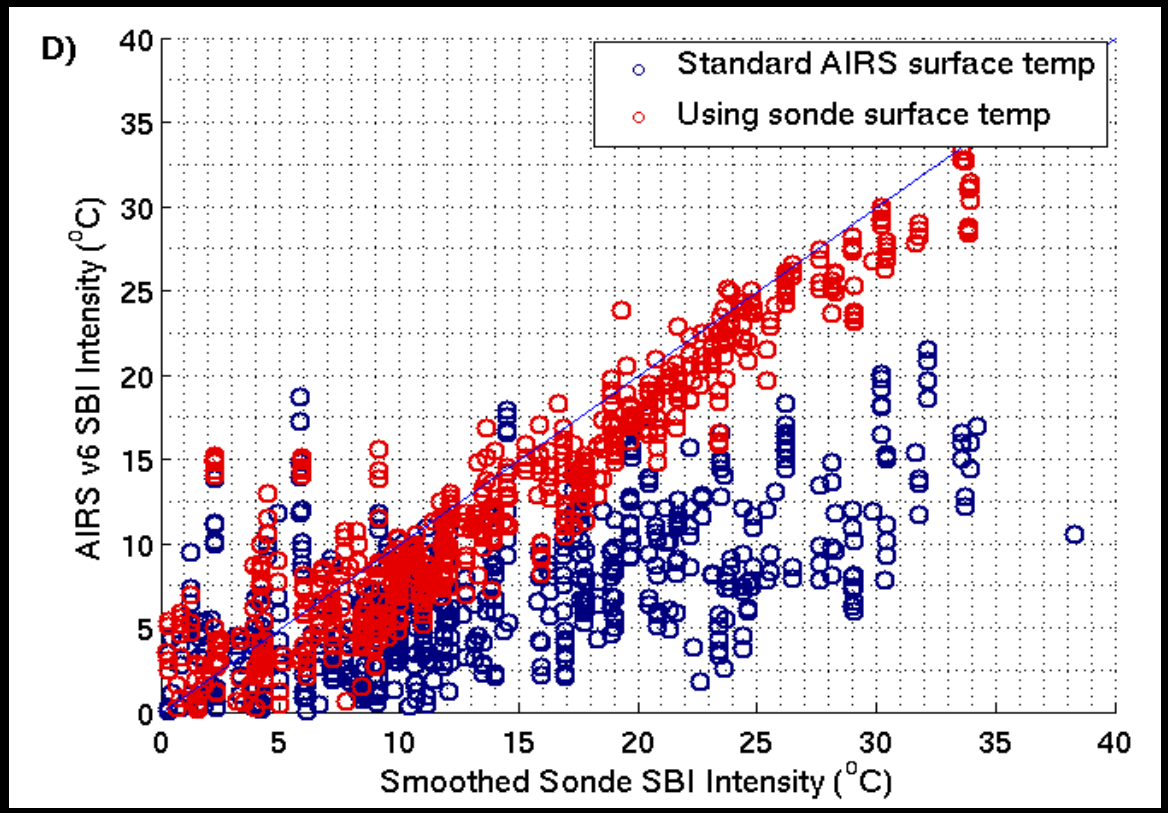
Top



AIRS SBI detection

- AIRS is doing the best it can to detect SBIs, given its limited vertical resolution.
- Both SBI occurance and depth show high agreement ~80%.
- AIRS underestimates SBI intensity by ~40%.
- Low SBI detection agreement over the ocean.

Full-Sonde
- 59% occurance agreement
- 70% w/ surface air temp change



Future Work

- Accurate surface air temperature is critical for SBI detection.
- ERA-Interim and new version of IASI are being utilized.
- Use of AIRS based SBIs for future research depends on objective/ accuracy required.